

WHAT IS CLAIMED IS:

1. An optical cross-connect comprising:
  - a plurality of input ports each operable to receive an optical input signal, each input signal comprising a plurality of channels that are each operable to carry optical traffic;  
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  - a plurality of output ports each operable to output an optical output signal;
  - a distributing amplifier associated with each input port, each distributing amplifier operable to generate a plurality of copies of the input signal received at the associated input port;
  - 10 a plurality of filter units each operable to:
    - receive a copy of one or more of the input signals from one or more of the distributing amplifiers;
    - forward traffic in selected channels of one or more of the copies;
  - a combining amplifier associated with each output port, each combining  
15 amplifier operable to:
    - receive the traffic in one or more channels forwarded by one or more of the filter units; and
    - combine the received traffic into an output signal to be output from the associated output port; and
  - 20 one or more regeneration modules each operable to regenerate the traffic in one or more channels of one or more of the input signals.
2. The optical cross-connect of Claim 1, wherein the regeneration modules each comprise:
  - 25 one or more transponders each operable to regenerate traffic in one or more channels; and
  - one or more combining amplifiers operable to combine regenerated traffic received from the one or more transponders.

3. The optical cross-connect of Claim 2, wherein the regeneration modules each further comprise:

one or more distributing amplifiers each operable to generate multiple copies of a received signal; and

5 one or more filter units each operable to forward traffic in selected channels of one or more of the copies to one or more of the transponders.

4. The optical cross-connect of Claim 2, wherein the regeneration modules each further comprise one or more demultiplexers each operable to:

10 separate a received signal into traffic in one or more constituent channels of the received signal; and

forward the traffic in one or more of the channels to one or more of the transponders.

15 5. The optical cross-connect of Claim 1, wherein one or more of the regeneration modules are further operable to convert the wavelength of the traffic in one or more channels of one or more of the input signals.

20 6. The optical cross-connect of Claim 1, wherein one or more of the regeneration modules are each positioned between an associated combining amplifier and an associated output port.

25 7. The optical cross-connect of Claim 1, wherein one or more of the regeneration modules are each positioned between an associated distributing amplifier and an associated input port.

8. The optical cross-connect of Claim 1, wherein one or more of the regeneration modules are positioned in a regeneration loop such that only traffic in one or more selected channels of one or more input signals is forwarded to the one or  
30 more regeneration modules for regeneration.

9. The optical cross-connect of Claim 1, wherein the distributing amplifiers each comprise a plurality of passive optical couplers operable to generate the plurality of copies of the associated input signal.

5 10. The optical cross-connect of Claim 1, wherein the combining amplifiers each comprise a plurality of passive optical couplers operable to combine the received traffic into the associated output signal.

10 11. The optical cross-connect of Claim 1, wherein the filter units are each operable to forward traffic in one or more selected channels by passing the traffic in selected channels and terminating the traffic in the remaining channels.

15 12. The optical cross-connect of Claim 1, wherein each filter unit comprises one or more filters, each filter operable to receive a copy of an input signal and to pass the traffic in selected channels and to terminate the traffic in the remaining channels of the particular input signal.

20 13. The optical cross-connect of Claim 12, wherein the filters comprise tunable filters.

14. An optical cross-connect comprising:
- a plurality of input ports each operable to receive an optical input signal, each input signal comprising a plurality of channels that are each operable to carry optical traffic;
- 5 a plurality of output ports each operable to output an optical output signal;
- a multicasting switch operable to forward one or more of the input signals to one or more filters;
- one or more filters each operable to:
- receive an input signal from the multicasting switch; and
- 10 forward traffic in selected channels of the input signal;
- a combining switch operable to:
- receive the traffic in one or more channels forwarded by one or more of the filters; and
- forward the traffic to one or more regeneration modules; and
- 15 one or more regeneration modules each operable to regenerate the traffic in one or more channels forwarded by the combining switch.
15. The optical cross-connect of Claim 14, wherein the multicasting switch is operable to forward at least one of the input signals to a plurality of the filters.
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16. The optical cross-connect of Claim 14, wherein the combining switch is operable to forward traffic received from a plurality of the filters to a single regeneration module.
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17. The optical cross-connect of Claim 14, wherein the regeneration modules each comprise:
- one or more transponders each operable to regenerate traffic in one or more channels; and
- one or more combining amplifiers operable to combine regenerated traffic
- 30 received from the one or more transponders.

18. The optical cross-connect of Claim 17, wherein the regeneration modules each further comprise:

one or more distributing amplifiers each operable to generate multiple copies of the traffic received from the combining switch; and

5 one or more filter units each operable to forward traffic in selected channels of one or more of the copies to one or more of the transponders.

19. The optical cross-connect of Claim 17, wherein the regeneration modules each further comprise one or more demultiplexers each operable to:

10 separate the traffic received from the combining switch into one or more constituent channels; and

forward the traffic in one or more of the channels to one or more of the transponders.

15 20. The optical cross-connect of Claim 14, wherein one or more of the regeneration modules are further operable to convert the wavelength of the traffic in one or more channels of the traffic received from the combining switch.

20 21. The optical cross-connect of Claim 14, wherein one or more of the regeneration modules are positioned in a regeneration loop such that only traffic in one or more selected channels of one or more input signals is forwarded to the one or more regeneration modules for regeneration.

22. The optical cross-connect of Claim 14, wherein the filters are each  
25 operable to forward traffic in one or more selected channels by passing the traffic in selected channels and terminating the traffic in the remaining channels.

23. The optical cross-connect of Claim 14, wherein the filters comprise  
30 tunable filters.

24. A method for cross-connecting optical signals, comprising:  
receiving an optical input signal at each of a plurality of input ports, each input  
signal comprising a plurality of channels that are each operable to carry optical traffic;  
generating a plurality of copies of one or more of the input signals;  
5 receiving a copy of one or more of the input signals at one or more filter units;  
forwarding traffic in selected channels of one or more of the copies received at  
each filter unit;  
combining the traffic received from two or more of the filter units;  
forwarding the combined traffic to one or more regeneration modules;  
10 regenerating the traffic received at the regeneration modules; and  
forwarding the regenerated traffic to one or more output ports to be output  
from the output ports.

25. The method of Claim 24, further comprising converting the  
15 wavelength of the traffic received at the regeneration modules.

26. The method of Claim 24, wherein the plurality of copies of one or  
more of the input signals are generated using a plurality of passive optical couplers.

20 27. The method of Claim 24, wherein the plurality of copies of one or  
more of the input signals are generated using a multiplexing switch.

28. The method of Claim 24, wherein the traffic is combined using a  
plurality of passive optical couplers.

25 29. The method of Claim 24, wherein the traffic is combined using a  
combining switch.

30 30. The method of Claim 24, wherein forwarding the traffic in one or more  
selected channels of a copy of an input optical signal comprises passing the traffic in  
selected channels of the signal and terminating the traffic in the remaining channels of  
the signal.

31. An optical cross-connect, comprising:

means for receiving a plurality of optical input signals, each input signal comprising a plurality of channels that are each operable to carry optical traffic;

means for generating a plurality of copies of each input signal;

5 means for forwarding traffic in selected channels of one or more of the copies to one or more output ports;

means for combining the traffic received at each output port into an optical output signal to be output from the output port; and

10 means for regenerating the traffic in one or more channels of one or more of the input signals.